GWSS Biological Control
Spring Report, 2005

The Biological Control Unit within the Pierce's Disease Control Program is charged with the development and optimization of the glassy-winged sharpshooter biological control strategies. There are four components to this work: agent selection, agent production, release strategy, and agent evaluation. All of these components are important but the quality aspects (selection and release strategy) are paramount; the production of large numbers of inappropriate agents cannot compare with the release of a small number of optimal agents that can reproduce and spread of their own accord.

In addition to the biological control responsibility, the group has an increasing role in support of research into biological control programs. An essential component of research into new glassy-winged sharpshooter (GWSS) control strategies is the provision of quality insects. Researchers can no longer rely on field-collected insects due to the increasing difficulty in collecting them from the field. The insects are difficult to rear, especially on a small scale. Consequently, the plants, GWSS, and parasitoids are provided to researchers whenever possible. The ARS receives 500 adult GWSS every two weeks for research in Parlier and Shafter (there are three research groups: McGuire, Groves, and Backus). A further nine research projects are supported by the provision of plants, GWSS, and/or wasps (Leopold, Federici, Morse, Miller, Hoddle, Johnson, Toscano, Hagler, and Labavich). In addition, GWSS eggs are provided for wasp colony maintenance in quarantine facilities at UC Riverside (see agent selection section).

Agent Selection

Gonatocerus morrilli **female**

Selecting the right organisms to use as natural enemies is critical to the success of biological control efforts. The ideal agent should establish stable populations in the field and reduce pest numbers to nondamaging levels without impacting non-target organisms.

Early studies on the glassy-winged sharpshooter revealed that the insect's most important natural enemies were tiny wasps that oviposited (laid eggs) in the eggs of the sharpshooters. The developing wasp kills the host egg and, when the adult emerges, the females mate and then disperse to search for more pest eggs to parasitize.

The importance of these agents is well illustrated by comparing GWSS populations in Hawaii and Tahiti. The pest arrived in Tahiti in 2000 and has become established on several islands in French Polynesia. A few native natural enemies have been found to attack GWSS eggs but the impact on GWSS population size is negligible. The population of GWSS is, consequently, out of control and can reach levels where plants become defoliated and can be killed. A similar pattern was anticipated in Hawaii when GWSS became established in Oahu; however, an important natural enemy also became established a few months later. Within six months, populations of GWSS decreased from weekly sticky trap catches of over 100 to fewer than five GWSS. Nearly all GWSS egg masses now found are parasitized.

***Anagrus epos* female**

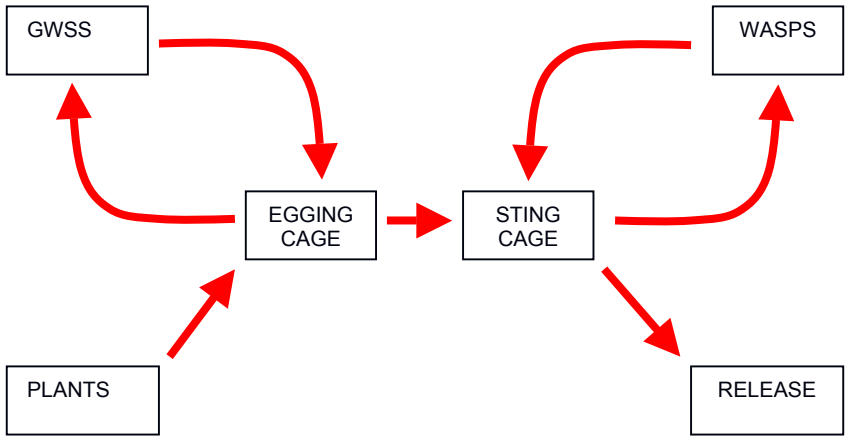
The first exploration for biological control agents was in 2000 and covered Texas, Louisiana, and northeastern Mexico. Over 10 species of egg parasitoid were screened in quarantine and three were ultimately approved for release into California: *Gonatocerus ashmeadi*, *G. morrilli,* and *G. triguttatus*. Another species, *G. fasciatus*, was permitted for release in 2001. All species are tiny Mymarid wasps, about the size of a grain of rice (approx. 1/16").

Since the initial exploration for biological control agents, searches have expanded through North America from Minnesota to the Yucatan Peninsula.

Surveys carried out by the Agricultural Research Service (USDA-ARS) over the past two years have resulted in the recovery of several potential agents from South America. These insects have not co-evolved with the GWSS but with closely related species. Nonetheless, they may be an improvement over co-evolved species as South American parasitoids can survive in arid climates typically found in grape-producing regions.

Presently, 13 populations of Mymarid parasitoids are being maintained in UC Riverside under quarantine and a further five species are at quarantine facilities in Mission, Texas. The insects were collected after exploration was carried out in North and South Mexico, Texas, Florida, Minnesota, Arizona, and Argentina. Two species of wasps have completed rigorous screening for non-target effects. *Anagrus epos* was collected from Minnesota in 2004 and is currently being permitted for release into California. This insect is minute, can produce over 10 offspring per sharpshooter egg and is capable of surviving severe winters. *Gonatocerus tuberculifemur* was collected in Argentina in 2003 where it is the most important natural enemy of the proconine sharpshooter, *Tapajosa rubromarginata*. This species is also being permitted for release, although approval may take up to a year.

Agent Production



In 2004, production of GWSS biological control agents in Kern County was relocated from Bakersfield to a site near Arvin. The opening coincided with the program's release of its millionth GWSS biological control agent in California. The field station is responsible for the production of agents for release in Kern, Tulare, Fresno, and Ventura. Renovation is ongoing with the aim of ultimately purchasing the site for use as a permanent biological control facility dedicated to the protection of California agriculture in the central valley.

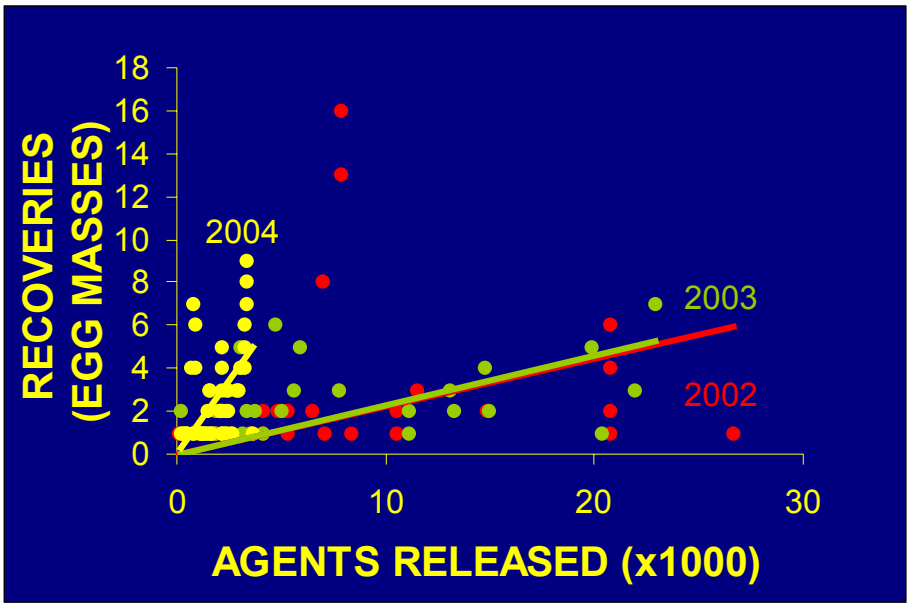
A second facility, Mount Rubidoux Field Station, is located in Riverside. This facility serves the seven southernmost counties and provides expertise, material, organisms, and space to more than 15 separate research projects aimed at the control of GWSS. Both Arvin and Mount Rubidoux facilities are charged with the identification, production, release, and evaluation of GWSS biological control agents, and with the development of techniques to optimize the efficacy of selected agents.

Producing parasites of GWSS at rearing facilities is challenging, because it requires culturing both the glassy-winged sharpshooter and its host plants. Field-collected and laboratory-reared sharpshooters are used to obtain eggs for producing the egg parasites. The program is constantly evaluating each step to look for ways to optimize overall production.

These facilities are extremely valuable to researchers as they maintain continuous populations of non-contaminated glassy-winged sharpshooters that are essential for many research projects. Researchers from laboratories throughout the world visit these facilities to learn the techniques involved in the production and maintenance of sharpshooter colonies.

Release Strategy and Agent Evaluation

Biological control releases started in 2000 and have now exceed 1.1 million biological control agents released. As a result of the relocation of one facility and an increased investment into the support of research into new control strategies, releases were lower than the previous year.



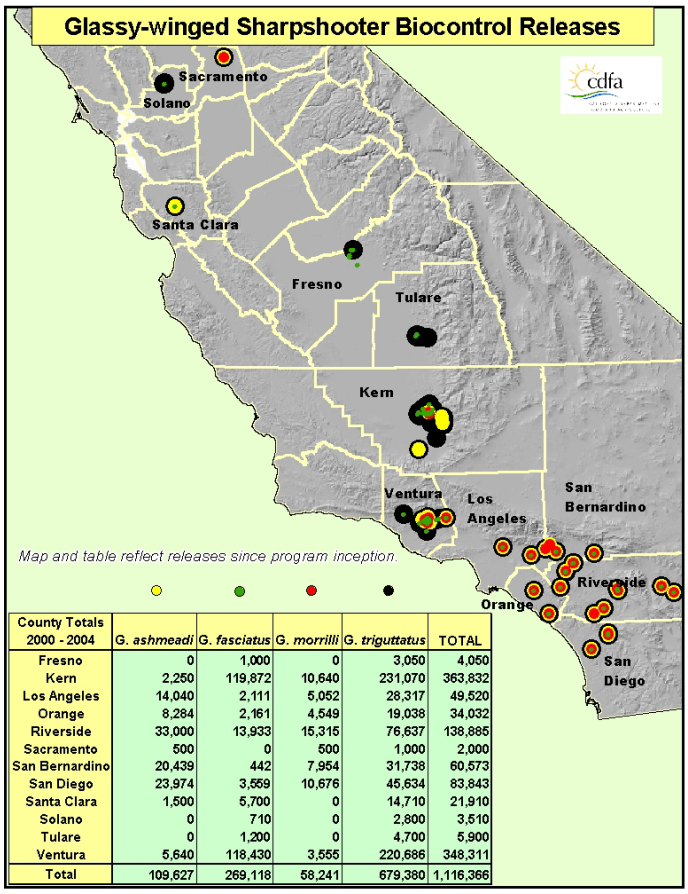
Release sites of biological control agents are surveyed twice a month and GWSS eggs are collected from the field to monitor and evaluate the program's release strategies. Over 144 parasitized egg masses have been recovered in the field to date. This is significant as it proves that parasitoids reared in the laboratory can survive and reproduce in the field. Further, recoveries of agents in 2004 were similar to those of 2003. It is too early to definitively explain the increased recovery to release ratio. The increase in recovery rate may be due to more efficient release methods, overwintering populations of agents or climatic factors. It may also be due to the smaller populations of GWSS that have been observed in the past year compared to 2000.

Four species of agents are continuing to be released throughout Southern California with additional releases made in Santa Clara, Sacramento, and Solano counties. After three years of monitoring, we are beginning to identify patterns regarding optimal species selection. For instance, *G. morrilli* is most frequently found at release locations that have maritime influences

while *G. fasciatus* is not being as successful as was initially hoped. Results from the monitoring efforts over the next year will assist us in making further management decisions regarding which species of agent should be released when and where.

The imminent addition of two further species to the biological control agent armory will further help us improve the efficacy of the biological control of GWSS.

This following year will see an increasing move to treat areas that cannot be controlled by insecticides, specifically urban, organic, and natural environments. The cities of Temecula, Bakersfield, Fresno, and Porterville will be the subjects of particular attention. The aim will be to minimize the risk of such areas acting as a refuge for pests that can then reinfest previously treated areas.



County Totals 2000 - 2004	*G. ashmeadi*	*G. fasciatus*	*G. morrilli*	*G. triguttatus*	TOTAL
Fresno	0	1,000	0	3,050	4,050
Kern	2,250	119,872	10,640	231,070	363,832
Los Angeles	14,040	2,111	5,052	28,317	49,520
Orange	8,284	2,161	4,549	19,038	34,032
Riverside	33,000	13,933	15,315	76,637	138,885
Sacramento	500	0	500	1,000	2,000
San Bernardino	20,439	442	7,954	31,738	60,573
San Diego	23,974	3,559	10,676	45,634	83,843
Santa Clara	1,500	5,700	0	14,710	21,910
Solano	0	710	0	2,800	3,510
Tulare	0	1,200	0	4,700	5,900
Ventura	5,640	118,430	3,555	220,686	348,311
Total	109,627	269,118	58,241	679,380	1,116,366

Current events

The USDA-APHIS areawide Program Director, Beth Stone-Smith, and the USDA survey crew have relocated to the CDFA Arvin Field Station. The move is further evidence of the excellent association that Federal, State, and county agencies have in challenging the GWSS / PD problem.

We have moved the majority of our release sites to areas that cannot be controlled through the use of insecticides. These include urban, organic, and natural ecosystems. Following the results that several small-scale releases of agents are more effective than one large-scale release, we are continuing to scout for release sites for limited releases. We are using several strategies to pinpoint GWSS hotspots. These include the use of sticky card trap catch data in urban areas, mapping of vulnerable organic production, and release of agents into retail nurseries so that the public can act as dispersal agents of the biological control agents when they purchase plants.

A permit for the release of *Anagrus epos* is expected within the next two weeks. The agent will be moved from quarantine into production and thence into the field. This minute insect is closely related to the world's smallest insect, the fairy fly.

Releases in the first three months of this year exceeded 30,000 parasitoids. This exceeds all previous releases for the same time period in past years, even though a large proportion of our production is now being dedicated to support of research.

An article describing the biological control of GWSS is due to be published in the following month's California Agriculture.